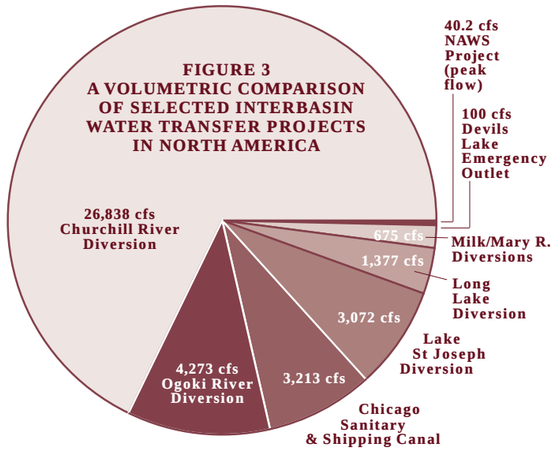
which were described here, that have little or no controls in place to prevent aquatic biota transfer. Many of these projects have been in place for over 50 years, and move vastly greater amounts of water than any proposed North Dakota water project.

When the volume of untreated and unfiltered water that is transferred across basin boundaries by existing projects is compared with NAWS, North Dakota's treated water supply project, and the proposed Devils Lake emergency outlet, it is clear that the risk of significant additional biota transfer occurring is extremely unlikely (Figure 3).



Note that the two North Dakota projects do not have visible portions due to their comparatively small volumes.

an assessment of risk

In addition to the many natural transfer mechanisms that exist, this brochure has shown that numerous water transfer pathways already exist to move biota between different drainage basins. North Dakota water projects clearly do not represent an increased risk, when compared with the many other untreated biota transfer pathways that have existed for more than half a century. If biota transfer is as important an issue as the degree of controversy generated by North Dakota water projects indicates, then there are several possible solutions.

Consideration should be given to the development of an independent review on the issue of biota transfer with three broad objectives.

1) An inventory of both the natural and man-made biota transfer pathways in Canada and the United States;

2) The development of a relative risk assessment of all biota transfer pathways; and

3) Provide recommendations on how best to prevent or treat those pathways.

the future of ND's projects

Biota transfer is an issue that has been raised repeatedly as the main reason to oppose several North Dakota water projects. However, there are many transport mechanisms that are already transferring biota today. When comparing North Dakota water projects with the existing water transfer projects profiled in this brochure, North Dakota proposed projects would be responsible for moving less than 1 percent of the water that is currently moved across basin boundaries today.

If biota transfer is of as great a concern, as has been indicated by those opposed to North Dakota water projects, then something must be done about this issue and those water transfer projects outside of North Dakota as well. If the potential for biota transfer from projects such as NAWS and the Devils Lake outlet are not an issue, as the evidence seems to indicate, then it is imperative that North Dakota's vital water projects be allowed to go forward, for the good of North Dakota's citizens.

additional information

If you have any questions or comments regarding this publication, or the biota transfer issue in general, please contact Lee Klapprodt, Director of the Planning and Education Division, State Water Commission, (701) 328-4970. E-mail address is lklap@swc.state.nd.us.

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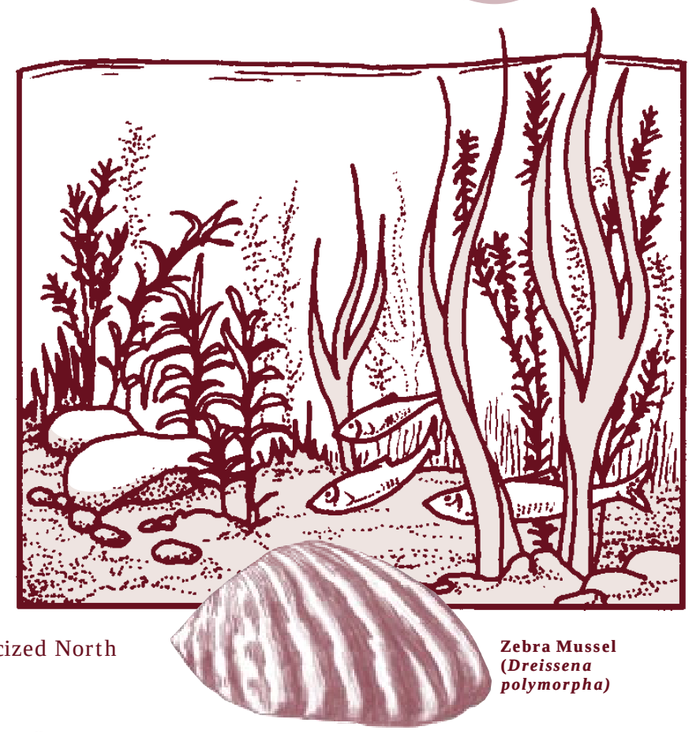
Understanding Biota Transfer waterguide

background

In recent years, the issue of biota transfer between watersheds has been raised time and time again. Biota transfer has been raised as the main reason that various groups oppose North Dakota water projects, such as the Devils Lake emergency outlet, and two vitally important Missouri River diversions, the Northwest Area Water Supply (NAWS) project, and the Red River Valley Water Supply Project. Unfortunately, conflicting and contradictory statements in the media have resulted in a great deal of public confusion about the subject. The purpose of this publication is to provide a general overview of the biota transfer issue, along with some examples that can put into perspective the exceedingly small risk associated with the often-criticized North Dakota water projects.



Zebra Mussel (*Dreissena polymorpha*)

what is biota transfer?

When discussing water projects, biota transfer refers to the artificial movement of aquatic life, whether it is fish, insects, plants, or diseases and pathogens, across a natural boundary that those organisms would otherwise have difficulty in crossing, such as a drainage basin divide. Specifically, the greatest concern for biota transfer has been those transfer pathways that move biota across continental divides, i.e., between drainage basins that drain into different oceans.

Biota transfer has occurred virtually everywhere in the United States in the last 100 years. Unfortunately, some of these transfers have caused problems. A good example of one of these problems would be the zebra mussel (*Dreissena polymorpha*), a species native to Europe, which was accidentally introduced into the Great Lakes via the ballast water of an ocean-going vessels. This prolific and destructive mussel has caused millions of dollars in damage to physical infrastructure, and has caused large losses in some fisheries.

the reality of biota transfer

In addition to water transfer projects, there are many other pathways by which aquatic biota have moved from one drainage basin to another. Some of the more common means of biota transfer include; fish stocking, fish farming, in the live wells and bilges of boats, physical attachment to boats and their trailers,

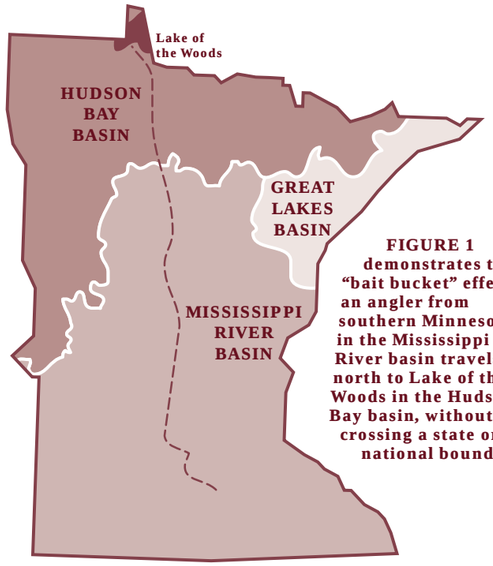


FIGURE 1 demonstrates the "bait bucket" effect: an angler from southern Minnesota in the Mississippi River basin travels north to Lake of the Woods in the Hudson Bay basin, without crossing a state or national boundary.

being washed across watershed boundaries during flooding, on or inside other animals such as migratory waterfowl, and the so-called "bait bucket" effect.

The "bait bucket" effect refers to the transfer of biota, via an angler's bait bucket. Many anglers are blissfully unaware of where one drainage basin ends and another begins, and often do not understand the consequences of introducing non-native biota.

A good example of the "bait bucket" effect would be to imagine an angler from southern Minnesota (Figure 1). This angler could buy bait from his local bait shop, and then drive to the northern end of Minnesota, to fish in the Lake of the Woods. At the end of his trip, the angler might empty his bait bucket into the lake, rather than disposing of his bait. This imaginary angler has now transferred biota across the continental divide, from the Mississippi River drainage basin, to the Hudson Bay drainage basin, without even leaving the boundaries of his state.

The previous example illustrates exactly how easy it is for the "bait bucket" effect to occur. Unfortunately, baitfish are not the only organisms that may be accidentally introduced via the "bait bucket" effect. If the baitfish from the previous example were carrying some aquatic disease, or there were bits of aquatic plant in that bucket, the angler may have inadvertently introduced those as well. Scientists have determined that, over time, the likelihood of the "bait bucket" effect transferring some types of aquatic biota is nearly 100 percent.

water transfer projects

As you can see, North Dakota water projects are not the only way that biota can be transferred. Water transfer projects, regardless of their location, must consider the risks of biota transfer, and take steps to reduce that risk. The following paragraphs examine seven interbasin water transfer projects that move water between major drainage basins, including the NAWS project (Figure 2).

1) Milk River and St. Mary River Diversions
Purpose: Irrigation in Montana and Alberta
Constructed By: USBR and Alberta
Flow: Montana Project- 650 cfs, Alberta Project- less than 25 cfs
Constructed: Montana Project- 1915, Alberta Project- 1890s and 1970
Connections: Missouri River Basin and Hudson Bay Basin
Biota Transfer Controls: None

2) Churchill River Diversion
Purpose: Hydroelectric power generation
Constructed By: Manitoba Hydro
Flow: 26,838 cfs
Constructed: 1976
Connections: Churchill River Basin to Nelson River Basin
Biota Transfer Controls: None

3) Lake St. Joseph Diversion
Purpose: Hydroelectric power generation
Constructed By: Hydro-Electric Power Commission of Ontario
Flow: 3,072 cfs
Constructed: 1950s
Connections: James Bay Basin to Nelson River Basin
Biota Transfer Controls: None

4) Ogoki River and Long Lake Diversions
Purpose: Hydroelectric power generation
Constructed By: Hydro-Electric Power Commission of Ontario
Flow: Long Lake 1,377 cfs, Ogoki River 4,273
Constructed: 1948 (for both)
Connections: James Bay Basin (Hudson Bay) to Great Lakes Basin
Biota Transfer Controls: None

5) Chicago Sanitary And Shipping Canal
Purpose: Sewage dilution, navigation, and hydroelectric power generation
Constructed By: Metropolitan Sanitary District of Greater Chicago
Flow: 3,213 cfs
Constructed: 1900, with additional connections in 1910, and 1922 (now 71 miles of canals)
Connections: Great Lakes Basin to Mississippi River Basin (both ways)
Biota Transfer Controls: Electrical barrier currently under construction, but additional controls proposed

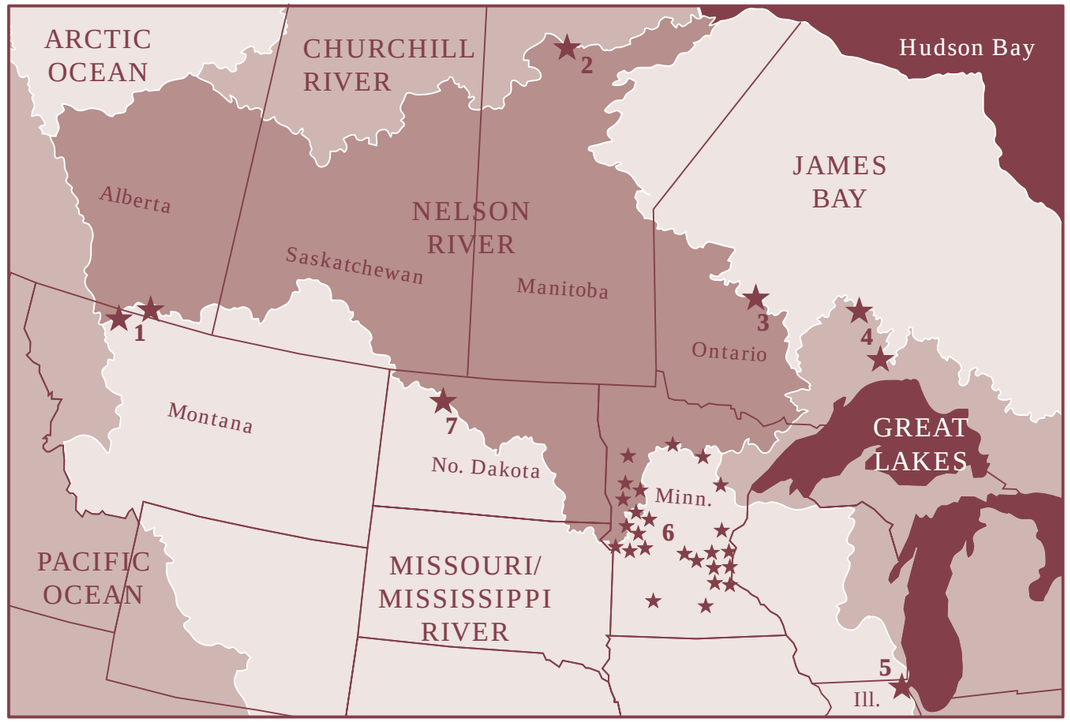


FIGURE 2 depicts the seven water projects profiled here, along with the major drainage basins.

6) Minnesota Closed-Basin Lake Outlets
Purpose: Flood control
Constructed By: Various; including federal, state, local, and private citizens
Flow: Various; anywhere from tiled up to 25 cfs
Constructed: Various; with 76 outlets having occurred within the last century to present time
Connections: Closed-basin lakes to external drainages
Biota Transfer Controls: None, although water quality monitoring required on certain drained lakes

7) Northwest Area Water Supply (NAWS) Project
Purpose: Municipal water supply
Constructed By: North Dakota State Water Commission
Flow: 40.2 cfs (peak capacity)
Constructed: Project began in 2002 (under construction)
Connections: Missouri River Basin to Hudson Bay Basin
Biota Transfer Controls:
Pre-Treatment: Chloraminated
Treatment: Softened, filtered, exposed to UV radiation, and chloraminated
Physical Controls: Automatic shutdown of key facilities in the event of the failure of critical equipment, five automated pipeline isolation valves for potential failures, containment of water at blow-offs and Air-Vac valves, SCADA system telemetry, stream crossings encased in concrete, cathodic protection of pipeline, and pipeline markers to avoid accidents with earthmoving equipment
Emergency Response Plans: Emergency response plan to be developed prior to operation of the system, but will include continuing consultation with Canada, and an annual operating report with Garrison Joint Technical Committee

preventing biota transfer

Because of North Dakota's concern over the potential of biota being introduced through NAWS into the Hudson Bay basin, numerous water treatment measures, such as filtration, and disinfection will be included in the project, and also physical control structures will be included in order to minimize the threat from leaks. The NAWS project represents a new era of water projects, as much concerned with preventing unwanted environmental effects, as it is with delivering water supplies critical to North Dakota's citizens.

In stark contrast to NAWS, there are numerous other water projects, only some of